The Determination of Interest Rates and the Effectiveness of Monetary Policy in Deregulated Financial Markets

Penelope N. Neal*

Abstract

This paper examines two issues pertinent to the effective implementation of monetary policy: firstly, the ability of the monetary authorities to control interest rates and secondly, whether interest rates have exhibited a leading relationship with economic activity since deregulation of the financial markets. If expenditures are unresponsive to changes in interest rates it is shown that the monetary authorities have the ability to determine the interest rate but if the authorities attempt to push interest rates into regions in which expenditures become interest rate elastic, a role for liquidity preference in determination of the interest rate is restored. This limits the effects of discretionary monetary policy to the short-term. Previous empirical studies, graphs and correlation coefficients indicate only limited evidence for a negative association between interest rates and changes in economic activity whereas Granger causality tests indicate that predictable relationships between interest rates and economic activity have existed in Australia for the period in which financial markets have been deregulated.

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1. Introduction

The choice of an intermediate target for conducting monetary policy is influenced by :

(a) stability and predictability of the relationship between the intermediate and ultimate target;

(b) provision of advance information about the growth of the ultimate target;

(c) controllability.(Monadjemi and Kearney (1990))

The Reserve Bank has explicitly acknowledged in recent years that monetary policy has been implemented by adjusting interest rates in order to influence expenditure. By choosing to influence interest rates the Reserve Bank has foregone control, but not necessarily influence, over determination of the size of the monetary aggregates. In December 1980, interest rate ceilings were removed from bank deposits. In June 1982, quantitative lending controls over banks were lifted and in December 1983 the Australian dollar was floated. Repurchase agreements between the Reserve Bank and the unauthorised money market dealers were introduced in August 1984. Attempts at targeting the growth rate of M3 were formally abandoned in January 1985. Deregulation of bank interest rates and quantitative lending controls removed the levers with which the central bank could directly control the size of the monetary aggregates. Disintermediation and reintermediation caused the relationship between the monetary aggregates and economic activity to shift negating the stability and predictability required between the intermediate and ultimate target. The changes outlined above suggest that monetary policy was, in effect, implemented using interest rates, rather than by restricting the quantity of money, at least from the September 1982 quarter rather than from the March 1985 quarter.

When the instrument of monetary policy is the interest rate, the monetary aggregates must be allowed to adjust in response to any changes in money demand brought about by variations in interest rates. Thus the monetary aggregates become endogenously determined by the demand for money and so lack any leading relationship with economic activity. Thus the standard transmission mechanism in deregulated financial markets is supposed to run from interest rates to aggregate demand or the exchange rate and thence to output and prices.

Deregulated financial markets and internationally mobile capital attract capital to areas of highest return. Thus Australian interest rates can not differ significantly from the interest rates of overseas countries from which Australia attracts large amounts of capital for assets of similar risk and maturity without affecting the exchange rate. Therefore, whilst the Reserve

Bank may not be able to determine long-term interest rates, these effectively being determined in international capital markets, the Reserve Bank does have a large degree of control over Australian short-term interest rates through open market operations and therefore has some influence over the size of the interest rate differential between Australia and overseas countries.

The influence of monetary policy is therefore not on long-term interest rates but on short-term interest rates. Whilst changes in short-term interest rates may have some impact upon investment and consumption expenditures one would expect that certainly the former should be more influenced by long-term interest rates, over which the Reserve Bank has little control, than by short-term rates. The empirical evidence of the second part of this paper, however, shows that changes in private gross fixed capital expenditure are influenced by real short-term interest rates. The Reserve Bank can influence short-term interest rates and thereby the exchange rate. It is this path through which we should expect to see monetary policy principally transmitted to the real economy in deregulated financial markets.

Open market operations affecting interest rates lead to variations of the interest rate differential between domestic interest rates and the interest rates of overseas economies. Suppose that monetary policy is tightened such that domestic interest rates rise whilst the interest rates of overseas economies remain unchanged. Higher interest rates in Australia tend to encourage capital inflow as the return on Australian interest bearing assets increases relative to the returns obtainable elsewhere.

However, not only must investors from overseas seeking to place their funds in Australian assets consider the interest rate differential; they must also consider the exchange rate expected to pertain when they wish to convert the Australian dollar interest returns upon their assets into the foreign currencies of their home economies. If the Australian dollar were expected to depreciate in the period between purchase of the asset and the payment of an interest return upon the asset, then the Australian dollar interest payment will purchase less foreign dollars than if the depreciation was not to occur. When the interest rate differential between domestic and foreign assets of similar risk is equal to the expected rate of exchange rate depreciation such that there is no further incentive for investors from overseas to purchase Australian assets there will be zero net capital inflow or outflow.

Meanwhile, increased capital inflow and an increased demand for Australian assets represents an increased demand for, and so causes an appreciation of, the Australian dollar. There is some evidence which shows that, for the period in which exchange rates have been floating, the exchange rate

is positively related to the real short-term interest rate differential. However, there is no reason to expect any relationship in past figures. An increase in the interest rate differential will raise the exchange rate above the level it otherwise would be at. It is likely that interest rates will often be raised in Australia to protect the exchnage rate; i.e., when other factors are forcing the exchange rate down.

Changes in the exchange rate will impact upon output by inducing expenditure switching. Higher interest rates leading to exchange rate appreciation induce consumers to switch away from domestic goods towards imports which are now relatively cheaper and cause foreigners to switch expenditures away from purchase of Australian exports. As net exports fall the price level will fall. Thus the transmission of interest rate changes through the exchange rate and the induced expenditure switching reinforce the effects on output and the price level of the impact of an expenditure reducing rise in interest rates upon domestic demand.

That monetary policy be effective in deregulated markets then relies upon the following propositions: that the authorities are able to influence domestic interest rates; and that either expenditure or the exchange rate is sensitive to changes in interest rates.

2. Determinants of Interest Rates and the Ability of the Monetary Authorities to Control Interest Rates

That expenditures are prone to be interest inelastic is a tenet of post Keynesian monetary economics. Important to the post Keynesian literature is that interest rates are set exogenously by the central bank so that the money supply becomes endogenously determined by the demand for money. Furthermore some post Keynesians accept that interest rates are only subject to central bank influence within the range of so-called interest rate indeterminacy, i.e., the vertical portion of the IS schedule, in which the real forces underlying productivity and thrift do not impact upon interest rates.

Therefore Dow and Saville (1990, p.67) argue that "..the authorities have influence over interest rates only because the influence that interest rates themselves exert is rather small. The conclusion appears to follow that the manipulation of interest rates cannot be a significant route to control effective demand (as is assumed in the IS/LM construct), or a policy instrument very relevant to the scale of unemployment that we in fact experience." And Moore (1988, p.263) states that "[r]eal forces of productivity and thrift affect nominal interest rates only indirectly, by determining

the upper and lower limits over which rates will be moved in pursuit of the central bank's ultimate policy goals."

The basis for Dow and Saville's conclusion rests upon a rejection of the loanable funds theory of the determination of interest rates. Any discrepancy between *ex ante* savings and investment is reconciled by means of adjustments in income through the Keynesian multiplier mechanism rather than adjustments in interest rates. If the demand for investment funds was to increase it is possible that in the short term upward pressure could be placed on interest rates. However, the increase in income eventually called forth by the rise in investment will bring about an increase in savings or supply of loanable funds such that the initial pressure for interest rates to rise will tend to be offset. The implication is that the interest rate is not determined by the interaction between the demand for loanable funds based upon the desire to add to the capital stock or the supply of loanable funds based upon the desire to add to wealth (the forces of productivity and thrift). The interest rate appears to be indeterminate upon this explanation.

As previously alluded to it has become increasingly accepted by post Keynesians and central bank practitioners[1] that the supply of money is endogenously determined by the demand for money so that the money supply cannot be determined independently of money demand. Thus liquidity preference must also be rejected as being the determinant of the rate of interest.

In rejecting the role of either loanable funds or liquidity preference in determination of the interest rate, emphasis may be placed upon the importance of expectations and the role of the central bank in influencing expectations. Because of the inverse relationship between the prices of financial assets and their yields, if the nominal interest rate paid upon financial assets is expected to fall the price of financial assets will be expected to rise. Participants in the financial markets will bring forth their purchases of these assets and so cause the price on these assets to rise and the yields to fall. Therefore the mere expectation of a fall in interest rates is self-fulfilling and determines the interest rate. Dow and Saville conclude therefore that the interest rate can thus not significantly diverge from that which it is expected to be. In an open economy, such as Australia is, the expected interest rate is heavily influenced by overseas interest rates. Keynes (1973, p.203) notes that: "It might be more accurate, perhaps, to say that the rate of interest is a highly conventional, rather than a highly psychological, phenomenon. For its actual value is largely governed by the prevailing view as to what its value is expected to be. *Any* level of interest which is accepted with sufficient conviction as *likely* to be durable *will* be durable; subject, of course, in a changing society to fluctuations for all kinds

of reasons round the expected normal." Furthermore, the short-term rate of interest is usually expected to be at a rate of the central bank's choosing.

Weakly held expectations enable the central bank to have a major role in the determination of interest rates. Expectations with respect to interest rates are weakly held firstly because interest rates largely are not determined by real forces. Secondly, the *flow* of new financial assets onto the market is small relative to the *stock* so that expectations of changes in the size of the flow only marginally affect the price of financial assets. This implies that factors other than any expected change in flows comes to dominate determination of the price of these assets. And thirdly, uncertainty with respect to the future price of assets increases the importance to operators in the market of forming and acting upon their own expectations of the expectations of other players in the market.

Expectations of the appropriate level for the interest rate therefore have no firm foundation grounded in objective or real forces, i.e. interest rates have become market-determined. The central bank, because of its ability to undertake large-scale operations in financial markets and therefore its potential to be a major player, can easily influence expectations of a change in interest rates even though the scale of its operations may generally be relatively small. This is so because the actions of the central bank increase the "weight"[2] or confidence that participants in the financial markets assign to the probability of movements in interest rates in the absence of any firmer criteria upon which to form an expectation as to the appropriate level for the interest rate.

If the Reserve Bank engages in open market operations to effect an easing of monetary policy, or even if it is only expected to do so, the financial market participants will respond in ways such that the reduction of interest rates is brought about. That this is so is evident from the falls in interest rates consequent upon expectations of an easing of official cash rates prior to any Reserve Bank action to bring about falls in official cash rates in 1990, 1991 and 1992. This is not to say that if the Reserve Bank did not subsequently act to reduce the official cash rate that market interest rates would not have returned to their previous levels. The point is that the market responds to expected intervention by the Reserve Bank in the determination of interest rates in the absence of a firmer basis with which to guage the appropriate level of interest rates.

However, the central bank's ability to influence interest rates in the longer-term is determined by the region in which expenditures are inelastic with respect to changes in the interest rate. The Reserve Bank can largely determine the short-term level of interest rates over any vertical portion of the IS schedule but should the IS schedule become elastic with respect to

changes in interest rates the response by economic agents will be to rapidly adjust the capital stock so that the demand for loanable funds increases (falls) and to desire to rapidly adjust wealth holdings so that the supply of loanable funds falls (increases). This will place pressure on interest rates to rise (fall). The IS schedule may be vertical for a variety of reasons. Firstly, estimates of expected returns on investment projects may be fraught with uncertainty. Thus small changes in interest rates may be insufficient to induce firms to respond with changes in investment expenditures. Secondly, in deregulated financial markets variable interest rate loans are more predominant than fixed interest rate loans. Therefore, if the central bank increases interest rates, that increase tends to be disseminated across the majority of loans whereas when interest rates were predominantly fixed an increase in interest rates fell only on new loans. Thus the impact of an increase in interest rates *of the same size* tended to be greater in regulated financial markets than is the case in deregulated financial markets. A further explanation for the lack of a negative association between interest rates and expenditure is that autonomous increases in demand initiate increases in the demand for money and credit, which given an unchanged money supply lead to increases in market-determined interest rates. In this case, interest rates will rise contemporaneously with expenditure. The following analysis considers the determination of interest rates and the effectiveness of monetary policy when the IS schedule contains regions which are both interest rate elastic and interest rate inelastic.

Suppose that real short-term interest rates have been pushed to very low levels by the Reserve Bank's open market operations such that the exchange rate depreciates and net exports increase as does income. This increase in income is going to increase the demand for money and restore a role for liquidity preference in the determination of the interest rate. For illustrative purposes assume that the price level is fixed so that the real interest rate is equal to the nominal interest rate. Consider Figure 1 which illustrates on the far left-hand side the market for Treasury Notes. The authorised money market dealers in times of liquidity shortage will have a supply schedule of Treasury Notes to be rediscounted at the Reserve Bank. By tailoring its acceptance of Treasury Notes the Reserve Bank can determine official cash rates. Suppose, for example that the Reserve Bank's initial demand schedule for Treasury Notes is D_0 such that the interest rate is r_0. An interest rate of r_0 implies that the quantity of money demanded and and so also the quantity of money supplied will be m_0. Now suppose that the Reserve Bank wishes to ease monetary policy. It does this by increasing its demand for Treasury Notes to D_1 so that the interest rate falls to r_1. At r_1 the quantity of money demanded and supplied increases to m_1.

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The right hand portion of Figure 1 shows an IS schedule which is inelastic over a range of interest rates. But outside that range of interest rates the IS schedule becomes interest elastic.[3] As the Reserve Bank causes the interest rate to fall from r_0 to r_1 income remains unchanged. There is no pressure for further change to the interest rate. Thus the short-term interest rate has been exogenously determined by the preferences of the Reserve Bank.

As the Reserve Bank further increases its demand for Treasury Notes from D_1 to D_2, interest rates fall further from r_1 to r_2 and income increases from y_0 to y_1. The increase in income to y_1 will cause the money demand schedule to increase to m^d_1 and so cause the interest rate to rise back to r_1. The excess demand for money at r_2 will cause an upward shift of the supply schedule for Treasury Notes (not illustrated). Unless the Reserve Bank is prepared to enter the money market again and further increase its demand for Treasury Notes,[4] the interest rate rather than being determined exogenously by the Reserve Bank (at r_2) has become endogenously determined by liquidity preference (at r_1).

Since the initial draft of this paper was written, I have become aware of a paper by Harper (1991) which comes to the same conclusion with respect to interest rate targeting: "[t]here is a limit to the length of time over which the RBA can keep the cash rate at the level of its choosing" (p.15), "[t]he induced changes in the demand for cash will tend to *counteract* the stimulatory or restrictive effects of changes in the supply of cash. Another way to make the same point is to say that the long-run impact of monetary policy is neutral, i.e., non-existent" (p.16), and "[i]n particular, the central bank will not be able to maintain a particular level of the cash interest rate in the long term without repeated bursts of monetary contraction or expansion. Interest rate targeting in the long term is ineffective and in the short-term is probably pro-cyclical" (p.18).

Thus the conclusion follows that the Reserve Bank is able to exogenously determine interest rates within the range in which expenditures are interest rate inelastic but attempts to set interest rates in regions where expenditures are responsive to changes in interest rates will meet with only limited success in the longer-term.

The above construct describes the way in which the Reserve Bank currently attempts to bring about variations in interest rates. The construct does not make use of an LM schedule but yet similar qualitative results to those obtained from use of the IS/LM construct are derived. However, the above construct better *explains* the processes by which variations in interest rates are engineered and changes in the money supply are generated.

The analysis of this section suggests that interest rates must be pushed to some "critical" level before affecting expenditures. The policy implica-

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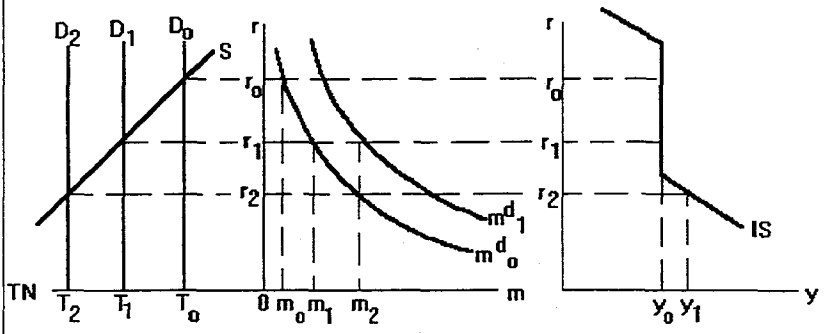
Figure 1.
The Central Bank and the Determination of Interest Rates



The Reserve Bank eases monetary policy by reducing interest rates from r_0 to r_1. To reduce interest rates it increases its demand for Treasury Notes from D_0 to D_1. As Treasury Notes are purchased from the official dealers the money supply increases from m_0 to m_1. However, as the IS schedule is inelastic over a range of interest rates income remains at y_0. If the Reserve Bank were to further reduce interest rates to r_2 by further increasing its demand for Treasury Notes to D_2 thereby increasing the money supply to m_2, income increases from y_0 to y_1. As income increases so does the demand for money from m^d_0 to m^d_1. If the Reserve Bank does not enter the market for Treasury Notes again, market forces will cause the interest rate to rise to r_1, and income to fall from y_1 to y_0. Therefore, the Reserve Bank can determine interest rates if expenditures are interest rate inelastic but if expenditures are elastic, interest rates become market determined and monetary policy may be ineffective.

tions of the analysis for current Reserve Bank operating procedure are that many small changes in interest rates may be far less effective and slower-acting than fewer but larger changes. if the Reserve Bank makes *substantial* enough changes to official cash rates there may be a short-term impact upon the level of economic activity, but as previously described the subsequent changes in money demand and interest rates may negate the short-term impact such that monetary policy becomes ineffective in the longer-term. Thus, monetary policy may be useful as a swing policy instrument whilst other policy measures which do have a longer term impact upon the level of activity take effect. The empirical evidence of the next section examines whether, in fact, monetary policy is useful as a swing policy instrument.

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3. Are Interest Rates Able to Predict Economic Activity?: Empirical Evidence

Some doubts have been raised as to the validity of the standard transmission mechanism between interest rates and activity in deregulated financial markets. Milbourne (1990) finds that periods of increased growth in investment are not correlated with a lower real interest rate and that there is little negative relationship between the real interest rate and real gross national expenditure. Figures 2 and 3 plot real short-term interest rates[5] against the annual percentage change of private gross fixed capital expenditure and gross national expenditure at constant prices from the September 1982 quarter to the June 1992 quarter. Correlation coefficients betweeen real short-term interest rates and the annual percentage change in real private GFKE and real GNE were calculated to be +.46393 and +.45193 respectively. Figures 2 and 3 and the correlation coefficients provide support for Milbourne's proposition that there appears to be little negative correlation between interest rates and private investment or GNE. They also provide casual support for the contention that interest rates must be pushed to "critical" levels before impacting upon expenditures.

As indicated earlier the major transmission mechanism of monetary policy may now be through the impact of changes in short-term interest rates upon the exchange rate and thence upon net exports. Figure 4 illustrating real short-term interest rates against net exports shows that a strong inverse relationship has existed between interest rates and net exports since 1984. (Recall that the exchange rate was floated in December 1983.) The correlation coefficient was calculated to be -.42097.

Although there seems to be little inverse relationship between real short-term interest rates and domestic demand (GNE), the inverse relationship existing between real short-term interest rates and net exports should lead real GDP to respond to changes in interest rates, a proposition which is not entirely borne out by examination of Figure 5. The correlation coefficient between real short-term interest rates and the annual percentage change in real GDP was +.41064.

To summarise, the pictorial evidence and correlation coefficients presented above suggest that the short term impact of changes in real short-term interest rates on investment, GNE and GDP is not in the desired direction, whereas the impact on net exports is in the desired direction.

This paper is not suggesting that changes in interest rates have no impact upon economic activity. Conversely, the rise in real short-term interest rates from 3 per cent in the September 1987 quarter to 10.7 per cent in the March 1989 quarter ultimately led to negative growth rates for private investment, GNE and GDP. The paper is suggesting, however, that it took a rise of over

Figure 2

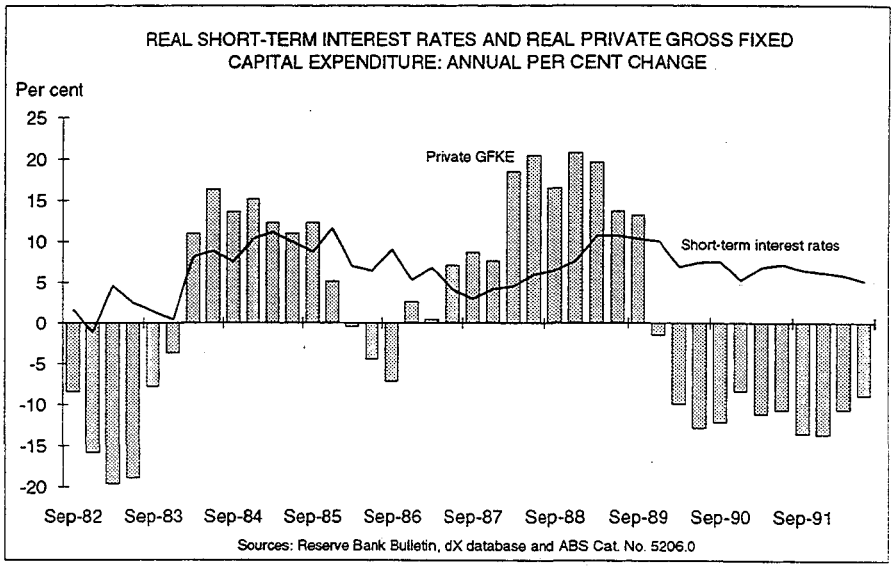

Figure 3

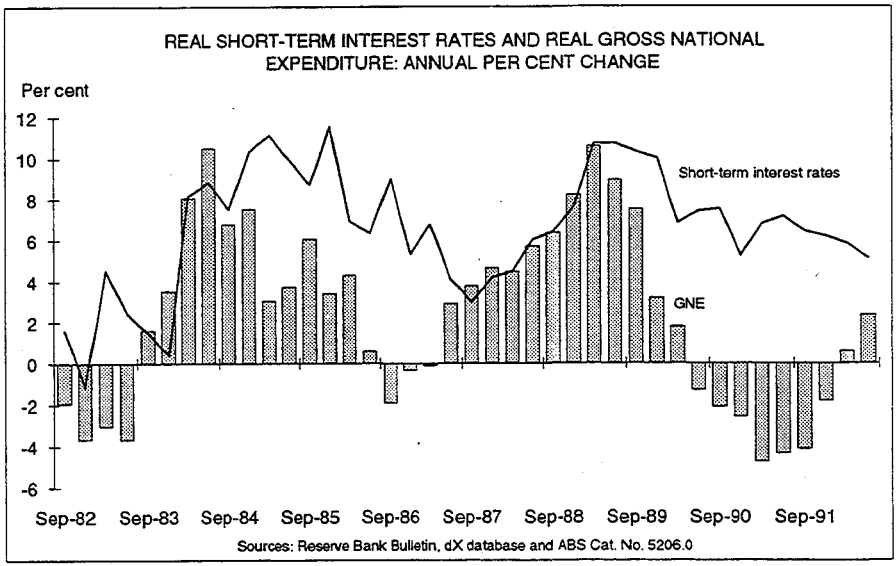

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Figure 4.

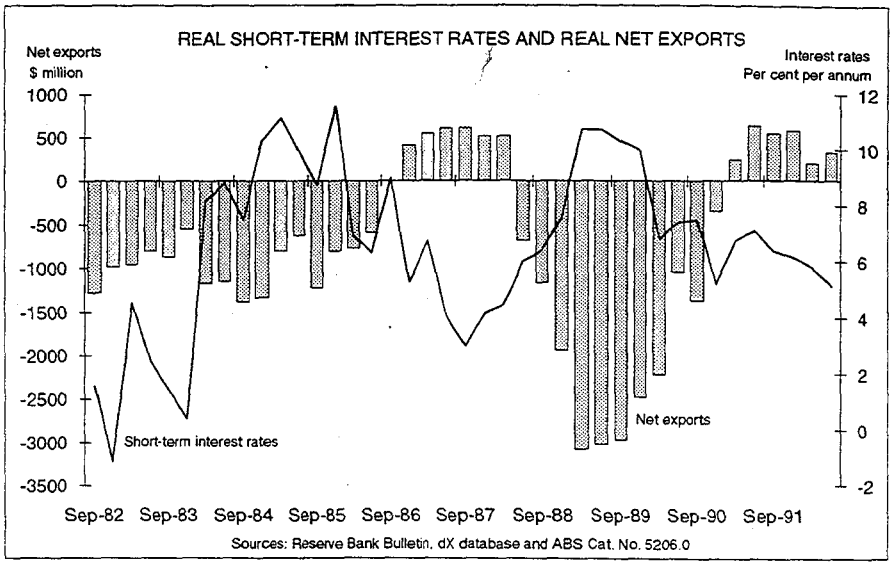
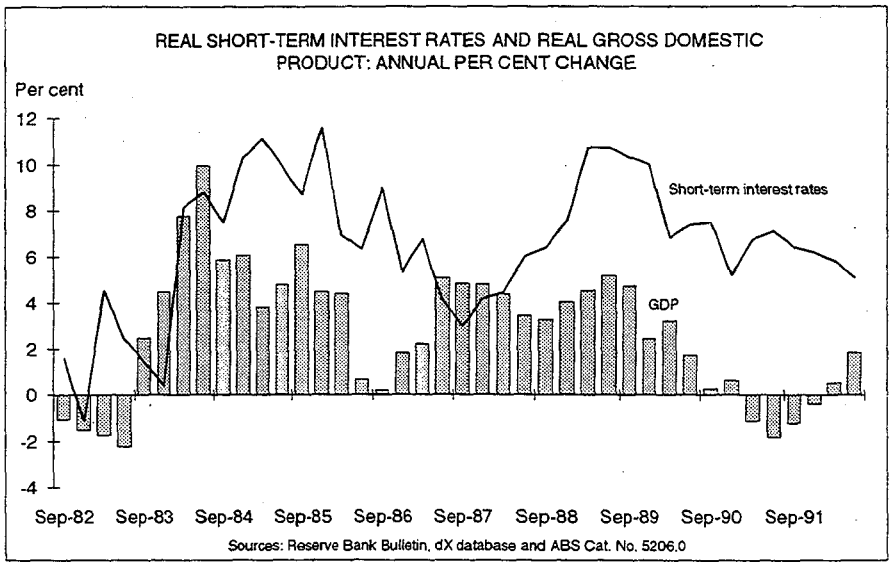


Figure 5.



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7 percentage points in *real* short-term interest rates over almost two years before the change in interest rates had an impact upon the level of economic activity. Consequently, it may be preferable to implement monetary policy by changing interest rates in much larger steps than is currently being undertaken to more quickly contract or expand the level of economic activity rather than in smaller steps as suggested by the Treasurer in comment with respect to the monetary policy easing of 8th July 1992: "I might suggest that we see them [changes in interest rates] occurring somewhat more frequently and in somewhat smaller measure.". In addition, larger changes in monetary policy may have larger "announcement effects" such that changes in interest rates more quickly affect the exchange rate and activity. Small incremental changes in interest rates may have almost no impact upon economic activity in the short-term and, as previously discussed, the long-term effects of monetary policy may be negligible as changes in income alter the demand for money.

Bullock, Morris and Stevens (1989), on the basis of graphical comparisons and correlation coefficients suggest that since deregulation the temporal ordering between monetary policy and activity has been for nominal interest rates to move first followed by M1 (as to be expected if the money supply is endogenously determined), real private demand and later by nominal demand. Other financial aggregates tended to move with, or a little later than, real private demand and coincidently with nominal demand. Based on vector autoregressions, Stevens and Thorpe (1989) found no strong statistical support for the proposition that nominal short term interest rates are consistently related to movements in economic activity. These results should be of concern to the Reserve Bank given the emphasis in recent years on the use of high interest rates as a swing policy instrument by the government, and suggest that the role of interest rates as a factor in the determination of economic activity be further examined. Milbourne (1990, p.269) cautions that "[T]he lags in monetary policy are long enough to raise debate about the circumstances under which monetary policy should respond to economic developments".

Predictable relationships between instruments and targets are required for the effective implementation of monetary policy. Thus it is of policy interest to determine if predictable relationships exist between interest rates, and investment, GNE and GDP in the deregulated financial system. Granger causality tests are a technique by which it may be determined if interest rates have a leading relationship with economic activity.

To examine the existence or otherwise of a leading relationship between interest rates and economic activity, Granger causality tests were undertaken for real short-term interest rates and annual percentage changes in real

private investment expenditure, real GNE and real GDP for the March 1984 quarter to the June 1992 quarter. The choice of March 1984 as the beginning of the sample period was influenced by the inclusion of lags of up to 6 quarters in the Granger causality tests. March 1984 lagged 6 quarters is the September 1982 quarter by which time short-term interest rates had become the instrument of monetary policy. In addition, Granger causality tests were undertaken for real short-term interest rates and the level of net exports for the same period. Some discussion of Granger causality and the results of the Granger causality tests are presented in the appendix to this paper.

Table 1 of the appendix indicates that changes in short-term interest rates do have an impact upon changes in private investment expenditures but also that there are feedback effects from changes in investment expenditures to changes in interest rates. Table 2 indicates that short-term interest rates do Granger cause changes in gross national expenditure i.e., short-term interest rates display a leading relationship with changes in gross national expenditure. The effects of short-term interest rates upon gross national expenditure are apparent for the one to six quarters for which the independent variables were lagged. Table 3 shows that net exports are Granger caused by short-term interest rates for lags of up to 3 quarters. There is some evidence of feedback effects between short-term interest rates and changes in GDP as can be seen in Table 4.

Whereas the graphical comparisons and the correlation coefficients indicated that interest rates were positively correlated with GFKE, GNE and GDP, the estimated coefficients on lagged values of interest rates when GFKE, GNE and GDP were regressed on interest rates were negative (on most lags) and the F-statistics in many of the Granger causality tests proved significant. There are several problems with using graphs and correlations as a basis for conclusions about the effect of interest rates. Firstly, the correlation may be spurious. Secondly, even when the dependent variable is stationary and so the effects of autocorrelation are removed, the value of the dependent variable for any given time period may be heavily influenced by its value in previous periods and visual examination of the graph will not capture the extent to which this is so. The Granger causality tests, however, estimate the influence of both lagged values of the dependent variable and lagged values of the interest rate and show that once the influence of lagged dependent variables has been taken into account, interest rates do impact negatively upon changes in economic activity.

Monadjemi and Kearney (1990) conclude by stating that "[S]ome economists argue that the old transmission mechanism of monetary policy is no longer applicable and authorities must seek more information regarding this important issue." It does seem however from the results of the Granger

causality tests presented in this paper that monetary policy does impact to some extent upon private gross fixed capital expenditure and does lead changes in domestic demand as evidenced by the Granger causality tests for interest rates and gross national expenditure. In addition to working on private investment short-term interest rates impact upon the exchange rate and therefore upon the imports component of gross national expenditure. Monetary policy has an impact upon net exports for a period of up to 9 months. That there is only some limited relationship between interest rates and GDP but that there is strong evidence of Granger causality between interest rates and net exports and interest rates and GNE suggests that monetary policy has a greater impact upon imports than exports.

Milbourne (1990) and Stevens and Thorpe (1989) suggest that interest rates may have responded because of a monetary policy reaction function to the growth of domestic demand and so affected the subsequent growth of the economy. This would seem to explain the apparently positive correlation between interest rates and economic activity that are exhibited for a large part of the period examined in Figures 5,6 and 8. But such a monetary policy reaction function would suggest that there should be feedback effects between interest rates and activity for which there is some evidence in Tables 1 and 4 and no evidence in Table 2.

5. Conclusion

The previous analysis addresses two of the necessary requirements for the choice of an instrument of monetary policy outlined at the beginning of this paper: the controllability by the authorities of interest rates and the predictability of the relationship between interest rates and economic activity. Previous empirical studies and the simple graphs and correlation coefficients of this paper suggested that there was only limited evidence for a predictable relationship, at least in the short term, between interest rates and economic activity in Australia since deregulation of the financial markets. In contrast, Granger causality tests conducted for the period in which financial markets have been deregulated, the results of which are presented in this paper, suggests that there is a predictable and negative relationship between real short-term interest rates and changes in real gross national expenditure, and between real short-term interest rates and changes in real net exports. Monetary policy is thus effective in the short-term. The central bank is able to exogenously determine or control short-term interest rates within the region in which expenditures are interest rate inelastic. However, if the central bank attempts to set interest rates at very high or very low levels, expenditures do become elastic with respect to the interest rate,

incomes fall or rise causing corresponding changes in money demand such that liquidity preference comes to dominate determination of the interest rate and monetary policy may be ineffective in the long-term.

The reasoning above suggests why the tight monetary policy of 1988 and 1989 took so long in bringing about recession in Australia, i.e., that interest rates had to be pushed to very high levels before having any substantial impact upon expenditure; and why, despite thirteen easings of official cash rates from January 1990 to July 1992, recovery is slow in arriving.

Appendix

Granger causality is said to exist when if Y_t is regressed against lagged values of Y_t and X_t, the estimated coefficients on X_t are significantly different from zero; but when X_t is regressed against lagged values of X_t and lagged values of Y_t, the estimated coefficients on Y_t are *insignificantly* different from zero. In this case, X_t is said to Granger-cause Y_t, i.e., the addition of X_t to the lagged values of the dependent variable generates better predictions than the information contained in past values of the dependent variable alone. Granger causality is therefore a test of whether a variable aids in prediction of another, *not* a test of causality.

Real short-term interest rates are expressed as per cent per annum. Gross fixed capital expenditure, gross national expenditure and gross domestic product are the annual percentage changes of seasonally adjusted data at 1984-85 average prices with the annual percentage changes of gross fixed capital expenditure and gross national expenditure being first differenced in order to achieve stationary series. The level of net exports, seasonally adjusted and at average 1984-85 prices was second differenced in order to achieve stationarity. The real short-term interest rate is defined as the 90 day bank adjusted bill rate less the inflation rate as calculated by the percentage change in the CPI. The CPI was used as it is the most accessible and widely disseminated measure of inflation and use of the actual rate avoids the problem of finding a proxy for expectations. Each variable was lagged 1 to 6 quarters. This allows for the lags of up to 18 months which may be necessary for the effects of monetary policy to be felt.

The top part of Table 1 shows the F-statistic associated with the Granger causality test of adding interest rates to changes in investment from an equation regressing changes in private investment both on lagged values of itself and lagged values of interest rates. The bottom part of Table 1 shows the F-statistic from a regression of interest rates on lagged values of interest rates and lagged values of private investment. If the F-statistics in the top

part only of Table 1 prove to be significant then interest rates are said to Granger-cause investment. If the F-statistics in the bottom part only of Table 1 prove to be significant then investment is said to Granger-cause interest rates. If the F-statistics in both the top and bottom part of Table 1 prove to be significant then feedback effects from investment to interest rates exist. The results of all Granger causality tests conducted are presented in Tables 1 to 4.

Table 1. Short-Term Interest Rates and Private Investment
Sample Period: March Quarter 1984 - June Quarter 1992

Dependent variable	Independent variables	No. of lags	F-statistic
GFKE	C, GFKE, R	1	10.58*
		2	9.39*
		3	5.25*
		4	3.33*
		5	3.10*
		6	2.60*
R	C, GFKE, R	1	5.65*
		2	2.87*
		3	2.57*
		4	1.21
		5	2.19
		6	1.84

* Significant at the 5 per cent level.

Sources: Australian Bureau of Statistics (1992) Catalogue No 206.0, Australian National Accounts National Income and Expenditure, June Quarter; dX database and Reserve Bank Bulletin, various issues.

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Table 2. Short-term Interest Rates and Gross National Expenditure
Sample Period: March Quarter 1984 - June Quarter 1992

Dependent variable	Independent variables	No. of lags	F-statistic
GNE	C, GNE, R	1	4.45*
		2	4.43*
		3	2.84*
		4	3.03*
		5	2.42*
		6	3.18*
R	C, GNE, R	1	.21
		2	1.05
		3	.85
		4	1.75
		5	1.12
		6	1.02

* Significant at the 5 per cent level.
Sources: As for Table

Table 3. Short-Term Interest Rates and Net Exports
Sample Period: March Quarter 1984 - June Quarter 1992

Dependent variable	Independent variables	No. of lags	F-statistic
NX	C,NX,R	1	5.89*
		2	4.24*
		3	2.95*
		4	1.87
		5	1.78
		6	1.03
R	C,NX,R	1	.02
		2	.10
		3	.11
		4	.39
		5	.26
		6	.20

* Significant at the 5 per cent level.

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Table 4. Short-term Interest Rates and GDP
Sample Period: March Quarter 1984 - June Quarter 1992

Dependent variable	Independent variables	No. of lags	F-statistic
GDP	C, GDP, R	1	.54
		2	4.20*
		3	2.19
		4	1.48
		5	2.07
		6	3.37*
R	C, GDP, R	1	4.14*
		2	2.19
		3	1.63
		4	2.44*
		5	2.44*
		6	2.03

* Significant at the 5 per cent level.
Sources: As for Table 1.

Notes

1. Included are the central bank practitioners of Australia: "For all intents and purposes, the quantity of "money", defined as M1, M3 or some other "M", will be determined endogenously: there is no thought of the central bank actually directly controlling the supply of this "M" as is assumed in the conventional textbook treatment, which describes the first stage of a change in monetary policy as "DM"." Macfarlane and Stevens (1989, p.5) and more generally: "Central Bank practitioners, almost always, view themselves as unable to deny the banks the reserve base that the banking system requires, and see themselves as setting the level of interest rates, at which such reserve requirements are met, with the quantity of money then simultaneously determined by the portfolio preferences of private sector banks and non-banks." Goodhart (1989, p.293).
2. The notion of "weight" is used here in Keynes' sense of the term: "As the relevant evidence at our disposal increases, the magnitude of the probability of the argument may either decrease or increase, according as the new knowledge strengthens the unfavourable or the favourable evidence; but *something* seems to have increased in either case,-we have a more substantial basis upon which to rest our conclusion. I express this by saying that an accession of new evidence increases the *weight* of an argument. New evidence will sometimes decrease the probability of an argument, but it will always increase its 'weight'." Keynes (1921, p.71).
3. Alternatively, the analysis might be applied to an IS schedule which is interest inelastic in the short-run but interest elastic in the long-run.
4. The Reserve Bank may be reluctant to do so as it now has to allow a greater

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increase in the money supply than that increase it had previously allowed in order to bring about the same interest rate. It may appear to the central bank that it is losing all control over the size of the monetary aggregates.

5. The real interest rate is defined as the 90 day bank adjusted bill rate less the inflation rate as measured by the percentage change in the CPI. Some would argue that such a short-term rate is inappropriate in the consideration of investment expenditures but Brennan and Milavec (1988, p.1) "use survey-based expectations data to examine how surprises in expectations affect the realisation of investment plans" and experimenting with both 90 day bank bill and 10 year Treasury Bond rates found that changes in *short-term* interest rates were significant in explaining the deviation of actual investment from expected investment in Australia from 1974-75 to 1986-87.

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